PROJECT NUMBER : 1812
PROJECT TITLE : New Expanded Tobacco
PROJECT LEADER : E. B. Fischer
PERIOD COVERED : February, 1991

I. BATCH GASEOUS CO_2 IMPREGNATION

A. **Objective:** Define process parameters for a batch gaseous CO_2 impregnation process.

B. **Results:** Impregnation and expansion tests were conducted on the 8 inch tower to produce various expanded tobacco types (liquid CO_2 control, cased and uncased feedstock using gaseous impregnation, plus several casing schemes, again using gaseous impregnation) for cigarette making. Standard gaseous impregnation conditions of 15 percent OV tobacco, in-situ flow through cooling to 10°F, and 800 psi impregnation pressure were used. These conditions resulted in a tobacco post vent temperature of about -10°F.

The expansion results of each of the gaseous impregnated fillers compared favorably with the liquid CO_2 control runs. The SV of the expanded filler ranged from about 2.9 to 3.2 cc/g compared to about 3.0 for standard DIET. Stability of the impregnated filler appeared to be adequate. CV's above 9.5 were typically obtained for the uncased tobacco feed. The expansion was less for the cased tobacco feed. CV's of only 8 to 9 were obtained.

A successful preliminary trial was conducted at the Bermuda Hundred Facility on February 15 to check out modifications to accommodate gaseous CO_2 impregnation. Based on the success of the trial run, software modifications were made to improve the operation and control of the gaseous impregnation process. A series of four runs was conducted February 26-28 to obtain an assessment of the degree of impregnation as well as tobacco survivability through the system.

C. **Plans:** Evaluate the data from the Bermuda Hundred runs and conduct additional tests to further define operating system modification requirements.

II. CONTINUOUS IMPREGNATION PROCESS

A. **Objective:** Develop a continuous impregnation process to improve the subjectives of expanded tobacco while maintaining equivalent cigarette filling power to the existing process.

B. **Results:** Work has been initiated to conduct a comparative study of the CO_2 handling requirements for the three continuous impregnation concepts being developed: 1)high pressure rotary valve, 2)linear pocket processor, and 3)conveyor impregnation process. The results of the study will be utilized in the selection of a continuous impregnation concept for prototype development.

2022201698

Source: https://www.industrydocuments.ucsf.edu/docs/ytjm0000

A second pilot test to evaluate the effect of casing with a 2.7 percent add-on of calcium acetate as a stiffening additive showed that the presence of casing had no effect on the performance of the additive. CV improvements with the additive of about 1.5 cc/g were confirmed.

To investigate the role of sugars in the stiffening effect, two samples of burley tobacco were treated, one with 2.7 percent calcium acetate and the other with 5 percent calcium hydroxide and run through the expansion process. No stiffening effect was observed for either. However, with the application of 10 percent glucose to the burley before 2.7 percent calcium acetate, a stiffening effect of 1.0 cc/g CV improvement was seen when compared to a control with only 10 percent glucose added. This needs to be studied before conclusions are reached about the importance of sugar.

C. Plans: Develop a profile of CV and add-on level for calcium acetate. After profiling the acetic acid removal ability of various processing steps, conduct tests with maximum potential for acetic acid reduction and evaluate subjectively to determine the acceptable threshold. Evaluate alternate systems which may have subjective advantages over calcium acetate. Conduct tests to evaluate the addition of a stiffening additive on strip prior to cutting. Complete tests to support mechanism studies.

2022201701

Source: https://www.industrydocuments.ucsf.edu/docs/ytjm0000

VI. TOWER HEAT TRANSFER RATES

A. **Objective:** Develop process information to define heat transfer parameters for the design of a new expansion tower. Test process concepts on the 8-inch tower leading to process and product improvement.

B. **Results:** The positive displacement feed valve design modifications have been completed. Plans are to install the modified valve assembly on the eight (8) inch tower. The cooling system will use liquid CO_2 at 100 psi to obtain subzero temperatures. Preliminary testing is scheduled for the week of March 4, 1991.

The mass spectrometer on-line monitor for tower gas analysis was operated for two weeks around-the-clock. Tower gas samples were taken at three different steam concentrations to complete the calibration.

A new tangential separator, modified to maintain the momentum of tobacco solids directed to the discharge rotary valve has been installed. The volume of the solids discharge section was significantly enlarged which should cut down on turbulence and help to obtain plug flow separation. Testing is scheduled for the week of March 4, 1991.

Heat transfer calculations using Dr. Zenz's correlation between Nusselt and Reynolds numbers were done for various tower lengths and at different tower conditions. Higher gas velocities result in higher extent of heat transfer, more than offsetting the reduction in residence time. Hence, for the same heat transfer, the tower length can be shorter when high gas velocity is used.

C. **Plans:** Install and test the modified positive displacement feed valve and the new tangential separator.

VII. CHEMICAL STIFFENING

A. **Objective:** Define a process to chemically stiffen expanded tobacco which will reduce thermal treatment and the associated subjective degradation while maintaining cigarette filling power equivalent to the current process.

B. **Results:** A comparison between products stiffened with 2.7 percent calcium acetate consistently showed that those products made on the 3 inch tower at 400°F, 100 percent steam had a 15 percent lower acetic acid content than those produced in the 8 inch tower at 400°F, 75 percent steam. This may explain why the presence of an acetic odor was not noted during tests on the 3 inch system. In addition, lab scale tests sweeping air through the product suggest that the acetate (acetic acid) is held differently by gaseous impregnated tobacco and liquid impregnated tobacco. This is indicated by the fact that the acetic acid content was reduced with air sweeping through the liquid impregnated sample with 2.7 percent add-on of calcium acetate while no change in acetic acid content was shown with the gaseous impregnated sample even after air sweeping for 72 hours. Tests are planned to confirm this and evaluate the effect of all processing steps on acetic acid reduction.

2022201700

Source: https://www.industrydocuments.ucsf.edu/docs/ytjm0000

C. Plans: Complete the comparative study of the CO_2 handling requirements for the continuous impregnation concepts.

III. ALTERNATE CONTINUOUS IMPREGNATION PROCESS

A. Objective: Evaluate the linear pocket processor (LPP) for continuous impregnation of tobacco filler.

B. Results: Tobacco degradation from feed to the cooler through the discharge from the LPP was studied. Filler was processed at 15 percent and 18 percent OV and at -10°F and 10°F for sieve analysis. Data and results are being analyzed.

Several areas of improvement for feeding the LPP were noted during experimentation. As throughput is increased from 200 to 600 lbs/hr, increased amounts of filler become trapped in the piston seals. Modifications are being made to clean the seals and alter the geometry of the feed section.

C. Plans: The model LPP will be used to evaluate tobacco feed and discharge design parameters for the prototype LPP.

IV. TOBACCO COOLING

A. Objective: Develop a continuous cooling process in support of the gaseous CO_2 impregnation program.

B. Results: Process conditions for achieving -10°F and +10°F tobacco at a throughput of 500 lbs/hr were defined. Uniform exit temperature was obtained. The unit has been incorporated into the 8 inch pilot system for evaluation with the batch gaseous impregnation process.

C. Plans: Widen the belt within the unit to reduce impregnator fill time. Continue test work with the cooler close coupled to the impregnator.

V. ALTERNATE PUFF/DRY/SET PROCESSES

A. Objective: Define alternate means of puffing, drying, setting, and reordering impregnated tobacco to improve product subjectives and physical characteristics relative to the present DIET process.

B. Results: Humid air conditions for reordering with minimum CV loss are being resolved in laboratory studies. Dew point condensation was shown to significantly contribute to collapse if not avoided by proper control of air conditions or tobacco temperature.

C. Plans: Continue laboratory studies to resolve feasibility of air reordering. Follow Frigoscandia's development efforts and test their unit in late March. Evaluate the Cardwell air/water spray unit which is expected to be delivered by the end of March.

2022201699

Source: https://www.industrydocuments.ucsf.edu/docs/ytjm0000